Docket # HK-769

CERTIFICATION

I, the below named translator, hereby declare that: my name and post office address stated below; that I am knowledgeable in the English and German languages, and th that the attached text is a true and complete translation of the German Patent Applic # 102 59 190.3-27, filed with the German Patent Office on December 18, 2002.

I hereby declare that all statements made herein of my own knowledge are true and t statements made on information and belief are believed to be true; and further that th statements were made with the knowledge that willful false statements and the like s punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the Uni Code and that such willful false statements may jeopardize the validity of the applicat patent issued thereon.

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Apparatus and method for distinguishing between flat objects

The invention relates to an apparatus and a method for detecting the material of flat objects on a stack, preferably a stack of printing plates, which are individually separated from one another by interlayers.

For individual processing, flat objects stacked on one another and, in particular, supplied in such a stack firstly have to be separated and then fed one after another individually into a processing machine. For example, in particular printing plates also have to be inserted individually into a printing plate exposer in order to expose them. This can be done manually. However, for reasons of economy of operation, preference is given to an automatic loading device (loader), which can be connected or attached upstream of a printing plate exposer. A stack of printing plates to be exposed is put into the loading device, and the loading device has a separating apparatus, with which automatic separation and loading of the printing plates is made possible, the printing plates and the interlayers being separated from one another.

The separation operation and loading operation can, however, be disrupted and the subsequent processing can be impaired or prevented by a plurality of objects adhering to one another or by an interlayer, which is intended to separate this object from a following or preceding object in the stack, adhering to said object. In the case of printing plates, paper sheets, for example, are used as interlayers for separation. Interlayers of this type can also not be provided or, in the individual case, can inadvertently be lacking or present in double layers. It can also happen that the printing plates

are located inverted on the stack, that is to say not as expected with the layer to be exposed at the top but with the rear of the carrier material at the top. Finally, it is also necessary to be able to detect the case in which the stack has been used, that is to say there is no longer a printing plate present.

Such faults must be detected reliably before the printing plates are loaded into the printing plate exposer, in order to prevent malfunctions of or even damage to the printing plate and the printing plate exposer. According to the prior art, sensors are predominantly used for this purpose which aim a light beam onto the surface of the flat object to be determined and, by measuring the intensity and/or color of the reflected light, determine the characteristics of the flat object, that is to say whether it is an exposure layer of a printing plate, the rear of a printing plate, whether it is a paper interlayer or whether there is no printing plate present at all. However, this measurement method has the disadvantage that it does not function reliably enough for all types of printing plates which are available and are used. There is too great a plethora of printing plates, whose exposure layers have different reflection characteristics. In addition, the reflection characteristics of the paper interlayers used vary to a great extent, depending on the type, color and surface smoothness of the paper used. The sensor device has to be calibrated in accordance with a complicated method for each new printing plate type that comes onto the market or else even when the manufacturer of the printing plates has merely changed the composition of the exposure layer or the color of the paper interlayers. Finally, there is also the risk that parts of the exposure layer will be pre-exposed by the optical sensors.

In US patent 6,042,101, use is made of a sensor that operates inductively, in order to detect whether a paper interlayer is still resting on a metallic printing plate. The sensor generates a magnetic field, whose change as the sensor is moved close to the printing plate is measured. When the sensor is resting directly on the printing plate, the result is a different magnetic field change to that when it is still at a short distance from the printing plate because of the paper layer. A conclusion about the presence of a paper interlayer is drawn from this difference.

In US patent 6,130,702, use is made of a sensor that operates capacitively, in order to detect whether a paper interlayer is still resting on a metallic printing plate. An electrode applied to the printing plate and the printing plate itself as matching electrode form a capacitor whose capacitance is measured. If a paper interlayer is present, the result is a lower capacitance than without a paper interlayer.

The invention is based on the object of indicating a method and an apparatus with which, during the separation of flat objects, in particular of printing plates, it is possible to detect reliably the material of the surface of the object that was taken from the stack before it is provided for further processing. In this case, a clear distinction between the various types of material is to be made possible, but the distinction is to be largely independent of the exact composition and of the variations within a type of material.

This object is achieved by a novel type of sensor apparatus, which is preferably integrated in a device for raising and separating the flat objects from the stack. Depending on the individual distinction made by the sensor apparatus, the

further sequence of the processing of the objects is controlled differently.

The sensor apparatus according to the invention achieves the object by measuring the electrical resistance to a high-frequency signal in the region of the object surface to be determined. For this purpose, contact is made between the surface and sensor electrodes and a high-frequency voltage is applied to the electrodes. A measuring current, whose current intensity depends on the electrical resistance of the surface, flows through the surface region between the electrodes. On the basis of the current intensity determined, a distinction is drawn as to the material of which the object surface consists.

Exemplary embodiments of the invention, from which further inventive features can also be taken, but to which the scope of the invention is not restricted, are illustrated in the drawings, in which, in schematic form:

Fig. 1 shows a lifting and separating apparatus for printing plates,

Figs 2a) to d) show the apparatus according to Fig. 1 during the separation of a printing plate,

Figs 3a) and b) show the sensor apparatus according to the invention,

Fig. 4 shows a block diagram of sensor electronics, and

Fig. 5 shows a block diagram of an alternative embodiment of the sensor electronics.

Fig. 1 shows, in schematic form and only in principle, a side or sectional view of an exemplary embodiment of an apparatus for separating printing plates from a stack, it being necessary to handle printing plates which have an extremely wide range of formats, thicknesses and coatings and are deposited in the plate stack individually separated from one another by paper interlayers. An apparatus of this type is described extensively in the unpublished patent application bearing the application number DE 101 34 151.2-27. It will therefore be described only briefly in order to describe the environment in which the sensor apparatus according to the invention is preferably to be used.

The embodiment illustrated in Fig. 1 comprises a cassette 1 in which a plate stack 2 is deposited. The respective upper printing plate is to be removed individually from this plate stack 2 and provided for onward transport, for example to be introduced into a printing plate exposer. The interlayer appearing under the respective printing plate removed is likewise to be removed from the plate stack 2 and deposited in an orderly fashion for disposal or for reuse.

In order to raise the marginal, top side of a printing plate or an interlayer from the plate stack 2, a substantially bar-like lifting device 3 with suction elements 4 is provided. In order to support the raised edge of the object lifted by the suction elements 4, a clamp element 5 can come into action for a certain time and engage under the object and clamp it together with the lifting device 3.

As a transport support for the raised object, use is made of a shutter 6 which can be moved under the object and on which the lifting device 3 can deposit the object after it has been released by the clamp element 5. The shutter 6 has its own

suction elements 8 which fix the deposited object from the underside. Said object can be a printing plate or an interlayer or else an interlayer which is still adhering to the underside of the deposited printing plate. A printing plate deposited on the shutter 6 is pushed over a doctor 9, after the suction elements 8 have released it, specifically onto a deposit table, not specifically illustrated, which adjoins the doctor in the same plane.

The shutter 6 is a constituent part of a circulating transport element 13 which runs in a closed loop over deflection rollers 11 and 14. In this case, the shutter 6 can be moved in two directions, namely, as a result of the transport element 13 circulating in the counterclockwise direction, into a holding position for a raised object and, as a result of the transport element 13 circulating in the clockwise direction, in order to transport and discharge a deposited printing plate over the doctor 9 and/or in order to carry along an interlayer attached by suction, in the direction of a paper tray 12.

The movement sequence of the apparatus according to Fig. 1 is illustrated in figs 2a) to 2d) in various operating phases during the separation of a printing plate 15. Identical elements, as also in the following figures, are designated by the same reference numbers as in Fig. 1, some of the reference numbers having been left out for reasons of clarity.

In Fig. 2a), the suction elements of the lifting device 3 come into action, grip the edge of the printing plate 15 at the top and lift said edge in the direction of the arrow 16.

In Fig. 2b), the clamp element 5 moves in the direction of the arrow 17 under the raised edge of the printing plate 15 and clamps and supports it.

In Fig. 2c), the deflection elements of the transport element rotate in the counterclockwise direction, in the direction of the arrow 18, and as a result move the shutter 6, as transport underlay, under the printing plate 15 which is consequently lifted further and as a whole.

In Fig. 2d), the lifting device 3 lowers the printing plate 15 in the direction of the arrow 20 onto the shutter 6 and, at the same time, the clamp element 5 releases the printing plate 15, by moving in the direction of the arrow 19. The suction elements 8 of the shutter 6 can also now come into action and attract the printing plate in the direction of the arrow 20 by suction and fix it on the shutter 6. The separated printing plate 15 is then ready for further processing, for example for the transport into a printing plate exposer.

Before the onward transport of the printing plate, a check is made with the sensor apparatus according to the invention to see whether a paper interlayer is still lying on the printing plate, whether the printing plate is located with the exposure layer or with the rear at the top, or whether a printing plate is present at all.

Fig. 3a) shows the sensor apparatus in a view of the front edge of the printing plate 15, that is to say in the direction of the arrow 21 in Fig. 2d). The sensor apparatus comprises a bar-like sensor carrier 30, to which two sensor electrodes 31, 32 are fitted. The sensor carrier 30 is pressed onto a surface of the printing plate 15 with a defined force in the direction of the arrows 35, so that a good electrical contact is produced between the sensor electrodes 31, 32 and the surface of the printing plate 15. At this time, the printing plate 15 is supported by a support surface 34 which, for

example, can be integrated into the shutter 6 or into the clamp element 5. However, a separate support surface 34 can also be provided in the transport path of the printing plate 15. The sensor electronics 33 required for the operation of the sensor apparatus are preferably also fitted to the sensor carrier 30. However, the sensor electronics 33 can also be accommodated at any other point on the printing plate loading device and connected to the sensor electrodes 31, 32 by a cable. The sensor apparatus is preferably integrated into the lifting device 3, but the sensor carrier 30 can also be mounted separately at any desired point above the printing plate 15.

Fig. 3b) shows the sensor carrier 30 together with the sensor electrodes 31, 32 and the sensor electronics 33 in a view from below. The sensor electrodes 31, 32 are connected to the sensor electronics 33 by leads 37, and the sensor electronics 33 are connected, via a cable plug 36 and a cable 38, to a device control system, not illustrated, belonging to the printing plate loading device. The device control system controls the further sequence of the separating and loading operation on the basis of the surface characteristic of the separated printing plate 15 determined by the sensor apparatus.

The functioning of the sensor apparatus is based, according to the invention, on a measurement of the electrical resistance to a high-frequency signal in the region of the surface with which contact is made by the sensor electrodes 31, 32. On the basis of series of measurements, it has been shown that, for the possible material surfaces (paper on a printing plate, exposure layer of the printing plate, carrier material of the printing plate, that is to say its rear, no printing plate), there are resistance ranges which are typical and can be

separated from one another, by measuring which the aforementioned types of surface can be distinguished. It is particularly advantageous in this case that the typical resistance ranges are largely independent of the type of interlayer paper or of the exact composition of the exposure layer on the printing plate. It is also characteristic and advantageous for the sensor apparatus according to the invention that contact is made only between the sensor electrodes 31, 32 and the material surface to be determined.

Fig. 4 shows a block diagram of the sensor electronics 33 in a preferred embodiment. Using a frequency generator 40, a high-frequency voltage is generated, preferably as a periodic square-wave signal and, for example, at a frequency of 33 MHz. A frequency differing from this or a sinusoidal voltage waveform are likewise possible. The high-frequency voltage is applied to the sensor electrodes 31, 32 in the manner of an alternating voltage, a measuring current 47 flowing between the electrodes through the surface region of the printing plate 15, its current intensity depending on the resistance in the surface region. In Fig. 4, the measuring current 47 is indicated by a dashed current path.

Using a rectifier 41 and a following measurement amplifier 42, the current intensity of the measuring current 47 is converted into an equivalent measuring voltage 48, which is led to a plurality of comparators 43, 44. The comparators compare the measuring voltage 48 with voltage ranges which are equivalent to the aforementioned typical resistance ranges for the various material types of the surface with which contact is made by the sensor electrodes 31, 32. If the measuring voltage 48 lies in the voltage range of a comparator, the comparator outputs a signal to the evaluation unit 46. For example, the first comparator 43 outputs an output signal if a

paper interlayer is still resting on the printing plate 15, the second comparator 44 outputs an output signal if the sensor electrodes 31, 32 are resting on the exposure layer of the printing plate 15, and so on. The evaluation unit 46 is, for example, in the simplest case, a digital encoder which converts the output signals from the comparators 43, 44 into a bit sequence which is subsequently forwarded to the device control system, not illustrated, belonging to the loading unit.

In the preferred embodiment of the sensor electronics 33, a short-circuit detector 45 is additionally provided, with which it is detected whether the sensor electrodes 31, 32 are making contact with the rear of a printing plate 15 with a metallic carrier material, for example aluminum. Since most by far of the printing plates used in practice have an aluminum carrier, this case will be detected reliably by the short-circuit detector 45. Of course, the short-circuit case can also be detected by a further comparator by using the measuring voltage 48. Likewise, further comparators can be provided, for example in order to detect the rear of printing plates with a nonmetallic carrier material, for example of polyester, or else further materials.

The entire sensor electronics 33 are preferably fed with a supply voltage which is electrically isolated from the rest of the separating and loading unit, in order to minimize the influences of the rest of the electrical device units on the sensor electronics 33. Likewise, the high-frequency signals from the sensor electronics 33 therefore cannot have a detrimental effect on the rest of the device units either.

Fig. 5 shows a further embodiment of the sensor electronics 33 as a block diagram. Instead of the frequency generator 40, a

controllable frequency generator 50 is provided, whose frequency can be set by the control and evaluation unit 52. Instead of the comparators 43, 44, there is an analog-digital converter 51, which converts the measuring voltage 48 into a digital measured value, which is processed by the control and evaluation unit 52. The control and evaluation unit 52 is, for example, a program-controlled unit, in which the measured value ranges of the various surface materials to be distinguished are stored as a function of the frequency of the voltage which is applied to the sensor electrodes 31, 32. If no unique material can be assigned to the determined measured value of a measurement, the controllable frequency generator 50 will be set to a different frequency and a further measurement carried out. Further measured values will be obtained with further variations in the measuring frequency, if appropriate. By means of the evaluation of the combination of the measured values obtained for various frequencies, the certainty of the correct detection of the surface material is increased. The sensor electronics 33 shown in Fig. 5 are also more flexible in relation to the calibration and setting to new or changed printing plate materials. For this purpose, only the measured value ranges stored in the control and evaluation unit 52 have to be adapted appropriately.

Besides the arrangement described previously and shown in Fig. 3a), in which the sensor carrier 30 with the sensor electrodes 31, 32 and the sensor electronics 33 is located above the separated printing plate 15 and is lowered onto the printing plate 15 from above for the purpose of measurement, alternatively or else additionally, an arrangement can be chosen in which the sensor apparatus is integrated into the support surface 34. In this case, the sensor apparatus is mounted rotated through 180 degrees in the support surface 34, so that the sensor electrodes 31, 32 point upward and project

out of the support surface 34. The printing plate 15 is then pressed onto the sensor electrodes 31, 32 from above for the purpose of measurement, and the material characteristic on the underside of the printing plate 15 is measured. If both arrangements are present, both sides of the printing plate 15 can be measured simultaneously or else successively. By comparing the measured values on the two sides of the printing plate 15, the certainty of the material determination can be increased still further.